非特殊角的三角函数精确值

$$\sin 45^{'}=\frac{1}{16}\left[\left(\sqrt{10+2\sqrt{5}}-\sqrt{15}+\sqrt{3}\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\left(\sqrt{30+6\sqrt{5}}+\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 45^{'}=\frac{1}{16}\left[\left(\sqrt{10+2\sqrt{5}}-\sqrt{15}+\sqrt{3}\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\left(\sqrt{30+6\sqrt{5}}+\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\sin 1^{\circ}52^{'}30^{''}=\frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 1^{\circ}52^{'}30^{''}=\frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 1^{\circ}52^{'}30^{''}=\sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 1^{\circ}52^{'}30^{''}=\sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 2^{\circ}15^{'}=\frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 2^{\circ}15^{'}=\frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 2^{\circ}15^{'}=\frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}-\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\cot 2^{\circ}15^{'}=\frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}+\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\sin 5^{\circ}37^{'}30^{''}=\frac{1}{2}\sqrt{2-\sqrt{2+\sqrt{2+\sqrt{2}}}}$$

$$\cos 5^{\circ}37^{'}30^{''}=\frac{1}{2}\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}$$

$$\tan 5^{\circ}37^{'}30^{''}=\sqrt{4+2\sqrt{2}}\left(\sqrt{2+\sqrt{2+\sqrt{2}}}-1\right)-\sqrt{2}-1$$

$$\cot 5^{\circ}37^{'}30^{''}=\sqrt{4+2\sqrt{2}}\left(\sqrt{2+\sqrt{2+\sqrt{2}}}+1\right)+\sqrt{2}+1$$

$$\sin 6^{\circ}45^{'}=\frac{1}{8}\left[\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\cos 6^{\circ}45^{'}=\frac{1}{8}\left[\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\tan 6^{\circ}45^{'}=\frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}-\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\cot 6^{\circ}45^{'}=\frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}+\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\sin 9^\circ 22' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 9^\circ 22' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 9^\circ 22' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 9^\circ 22' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 13^\circ 7' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 13^\circ 7' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 13^\circ 7' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 13^\circ 7' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 15^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 15^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 15^\circ 45' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}-\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\cot 15^\circ 45' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}+\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\sin 16^\circ 52' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2+\sqrt{2-\sqrt{2}}}}$$

$$\cos 16^\circ 52' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2+\sqrt{2-\sqrt{2}}}}$$

$$\tan 16^\circ 52' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2+\sqrt{2-\sqrt{2}}}-1\right)-\sqrt{2}+1$$

$$\cot 16^\circ 52' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2+\sqrt{2-\sqrt{2}}}+1\right)+\sqrt{2}-1$$

$$\sin 20^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2-\sqrt{2}}} - \sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}\right]$$

$$\cos 20^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2-\sqrt{2}}} + \sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}\right]$$

$$\tan 20^\circ 15' = \frac{1}{4}\left(4+\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)} - \sqrt{4+2\sqrt{2}} + \sqrt{5+\sqrt{5}} - \sqrt{5} - 1\right]$$

$$\cot 20^\circ 15' = \frac{1}{4}\left(4+\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)} - \sqrt{4+2\sqrt{2}} - \sqrt{5+\sqrt{5}} + \sqrt{5} + 1\right]$$

$$\sin 20^\circ 37' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 20^\circ 37' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 20^\circ 37' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}} - \sqrt{2}\right) - \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 20^\circ 37' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}} + \sqrt{2}\right) + \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 24^\circ 22' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 24^\circ 22' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 24^\circ 22' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}} - \sqrt{2}\right) + \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 24^\circ 22' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}} + \sqrt{2}\right) - \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 24^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)} - \left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 24^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)} + \left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\tan 24^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)} + \sqrt{4-2\sqrt{2}} - \sqrt{5+\sqrt{5}} - \sqrt{5} - 1\right]$$

$$\cot 24^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)} + \sqrt{4-2\sqrt{2}} + \sqrt{5+\sqrt{5}} + \sqrt{5} + 1\right]$$

$$\sin 28^\circ 7' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2-\sqrt{2-\sqrt{2}}}}$$

$$\cos 28^\circ 7' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2-\sqrt{2-\sqrt{2}}}}$$

$$\tan 28^\circ 7' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2-\sqrt{2-\sqrt{2}}}-1\right)+\sqrt{2}-1$$

$$\cot 28^\circ 7' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2-\sqrt{2-\sqrt{2}}}+1\right)-\sqrt{2}+1$$

$$\sin 29^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 29^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\tan 29^\circ 15' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}-\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\cot 29^\circ 15' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}+\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\sin 31^\circ 52' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 31^\circ 52' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 31^\circ 52' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 31^\circ 52' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 35^\circ 37' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 35^\circ 37' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 35^\circ 37' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 35^\circ 37' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 38^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 38^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 38^\circ 15' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{4+2\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}-\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\cot 38^\circ 15' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{4+2\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\sin 39^\circ 22' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2-\sqrt{2+\sqrt{2}}}}$$

$$\cos 39^\circ 22' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2-\sqrt{2+\sqrt{2}}}}$$

$$\tan 39^\circ 22' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2-\sqrt{2+\sqrt{2}}}-1\right)+\sqrt{2}+1$$

$$\cot 39^\circ 22' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2-\sqrt{2+\sqrt{2}}}+1\right)-\sqrt{2}-1$$

$$\sin 42^\circ 45' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\cos 42^\circ 45' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\tan 42^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}+\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\cot 42^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}-\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\sin 43^\circ 7' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 43^\circ 7' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 43^\circ 7' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 43^\circ 7' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 46^\circ 52' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 46^\circ 52' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 46^\circ 52' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 46^\circ 52' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 47^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\cos 47^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\tan 47^\circ 15' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}-\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\cot 47^\circ 15' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}+\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\sin 50^\circ 37' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2-\sqrt{2+\sqrt{2}}}}$$

$$\cos 50^\circ 37' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2-\sqrt{2+\sqrt{2}}}}$$

$$\tan 50^\circ 37' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2-\sqrt{2+\sqrt{2}}}+1\right)-\sqrt{2}-1$$

$$\cot 50^\circ 37' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2-\sqrt{2+\sqrt{2}}}-1\right)+\sqrt{2}+1$$

$$\sin 51^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 51^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 51^\circ 45' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{4+2\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\cot 51^\circ 45' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{4+2\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}-\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\sin 54^\circ 22' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 54^\circ 22' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 54^\circ 22' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 54^\circ 22' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 58^\circ 7' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 58^\circ 7' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 58^\circ 7' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 58^\circ 7' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 60^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 60^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\tan 60^\circ 45' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}+\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\cot 60^\circ 45' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}-\sqrt{4-2\sqrt{2}}-\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\sin 61^\circ 52' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2-\sqrt{2-\sqrt{2}}}}$$

$$\cos 61^\circ 52' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2-\sqrt{2-\sqrt{2}}}}$$

$$\tan 61^\circ 52' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2-\sqrt{2-\sqrt{2}}}+1\right)-\sqrt{2}+1$$

$$\cot 61^\circ 52' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2-\sqrt{2-\sqrt{2}}}-1\right)+\sqrt{2}-1$$

$$\sin 65^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}+\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 65^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}-\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\tan 65^\circ 15' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}+\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\cot 65^\circ 15' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}-\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\sin 65^\circ 37' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 65^\circ 37' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 65^\circ 37' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 65^\circ 37' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 69^\circ 22' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 69^\circ 22' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 69^\circ 22' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 69^\circ 22' 30'' = \sqrt{8+4\sqrt{3}-3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 69^\circ 45' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}+\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}\right]$$

$$\cos 69^\circ 45' = \frac{1}{8}\left[\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}-\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}\right]$$

$$\tan 69^\circ 45' = \frac{1}{4}\left(4+\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}-\sqrt{4+2\sqrt{2}}-\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\cot 69^\circ 45' = \frac{1}{4}\left(4+\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}-\sqrt{4+2\sqrt{2}}+\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\sin 73^\circ 7' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2+\sqrt{2-\sqrt{2}}}}$$

$$\cos 73^\circ 7' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2+\sqrt{2-\sqrt{2}}}}$$

$$\tan 73^\circ 7' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2+\sqrt{2-\sqrt{2}}}+1\right)+\sqrt{2}-1$$

$$\cot 73^\circ 7' 30'' = \sqrt{4-2\sqrt{2}}\left(\sqrt{2+\sqrt{2-\sqrt{2}}}-1\right)-\sqrt{2}+1$$

$$\sin 74^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 74^\circ 15' = \frac{1}{8}\left[\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 74^\circ 15' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}+\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\cot 74^\circ 15' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}-\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\sin 76^\circ 52' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 76^\circ 52' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 76^\circ 52' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 76^\circ 52' 30'' = \sqrt{8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sin 80^\circ 37' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\cos 80^\circ 37' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}}$$

$$\tan 80^\circ 37' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 80^\circ 37' 30'' = \sqrt{8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 83^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\sqrt{\left(10+2\sqrt{5}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\cos 83^\circ 15' = \frac{1}{8}\left[\left(\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\sqrt{\left(10+2\sqrt{5}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}\right]$$

$$\tan 83^\circ 15' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}+\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right]$$

$$\cot 83^\circ 15' = \frac{1}{4}\left(\sqrt{10}-\sqrt{2}+4\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(4+2\sqrt{2}\right)}+\sqrt{4-2\sqrt{2}}-\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right]$$

$$\sin 84^\circ 22' 30'' = \frac{1}{2}\sqrt{2+\sqrt{2+\sqrt{2+\sqrt{2}}}}$$

$$\cos 84^\circ 22' 30'' = \frac{1}{2}\sqrt{2-\sqrt{2+\sqrt{2+\sqrt{2}}}}$$

$$\tan 84^\circ 22' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2+\sqrt{2+\sqrt{2}}}+1\right)+\sqrt{2}+1$$

$$\cot 84^\circ 22' 30'' = \sqrt{4+2\sqrt{2}}\left(\sqrt{2+\sqrt{2+\sqrt{2}}}-1\right)-\sqrt{2}-1$$

$$\sin 87^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}+\left(\sqrt{5}+1\right)\sqrt{2+\sqrt{2-\sqrt{2}}}\right]$$

$$\cos 87^\circ 45' = \frac{1}{8}\left[\sqrt{\left(10-2\sqrt{5}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}-\left(\sqrt{5}+1\right)\sqrt{2-\sqrt{2-\sqrt{2}}}\right]$$

$$\tan 87^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}+\sqrt{5+\sqrt{5}}+\sqrt{5}+1\right]$$

$$\cot 87^\circ 45' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(4-2\sqrt{2}\right)}+\sqrt{4+2\sqrt{2}}-\sqrt{5+\sqrt{5}}-\sqrt{5}-1\right]$$

$$\sin 88^\circ 7' 30'' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\cos 88^\circ 7' 30'' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}}$$

$$\tan 88^\circ 7' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}}+\sqrt{2}\right)+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 88^\circ 7' 30'' = \sqrt{8+4\sqrt{3}+3\sqrt{6}+5\sqrt{2}}\left(\sqrt{4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}}-\sqrt{2}\right)-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sin 89^\circ 15' = \frac{1}{16}\left[\left(\sqrt{10+2\sqrt{5}}-\sqrt{15}+\sqrt{3}\right)\sqrt{2-\sqrt{2+\sqrt{2}}}+\left(\sqrt{30+6\sqrt{5}}+\sqrt{5}-1\right)\sqrt{2+\sqrt{2+\sqrt{2}}}\right]$$

$$\cos 89^\circ 15' = \frac{1}{16}\left[\left(\sqrt{10+2\sqrt{5}}-\sqrt{15}+\sqrt{3}\right)\sqrt{2+\sqrt{2+\sqrt{2}}}-\left(\sqrt{30+6\sqrt{5}}+\sqrt{5}-1\right)\sqrt{2-\sqrt{2+\sqrt{2}}}\right]$$

$$\sin 1^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\cos 1^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\tan 1^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}-\sqrt{5}-5+3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 1^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}+\sqrt{5}+5+3\sqrt{2}+\sqrt{3}+\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 1^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1-\sqrt{6}-\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\csc 1^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1+\sqrt{6}+\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\sin 10^\circ 30' = \frac{\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\cos 10^\circ 30' = \frac{\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\tan 10^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}-\sqrt{3}+1\right)\left(5-\sqrt{5}+\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}+\sqrt{15}-\sqrt{30}\right)$$

$$\cot 10^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}+\sqrt{3}-1\right)\left(5-\sqrt{5}-\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 10^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}+1-\sqrt{5}-2\sqrt{3}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}\right]$$

$$\csc 10^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}-1+\sqrt{5}+2\sqrt{3}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}\right]$$

$$\sin 16^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\cos 16^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\tan 16^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}+5+\sqrt{5}+3\sqrt{2}+\sqrt{3}+\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 16^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}-5-\sqrt{5}+3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 16^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1+\sqrt{6}+\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\csc 16^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1-\sqrt{6}-\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\sin 19^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\cos 19^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\tan 19^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}+\sqrt{5}-5-3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 19^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}-\sqrt{5}+5-3\sqrt{2}+\sqrt{3}-\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 19^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}+\sqrt{6}-\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}\right]$$

$$\csc 19^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}-\sqrt{6}+\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}\right]$$

$$\sin 25^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\cos 25^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\tan 25^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}+\sqrt{3}-1\right)\left(5-\sqrt{5}+\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}+\sqrt{15}-\sqrt{30}\right)$$

$$\cot 25^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}-\sqrt{3}+1\right)\left(5-\sqrt{5}-\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 25^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}+1-\sqrt{5}-2\sqrt{3}\right)\left[\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\csc 25^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}-1+\sqrt{5}+2\sqrt{3}\right)\left[\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\sin 28^\circ 30' = \frac{2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\cos 28^\circ 30' = \frac{2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\tan 28^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}-\sqrt{3}+1\right)\left(5+\sqrt{5}+\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}-\sqrt{15}-\sqrt{30}\right)$$

$$\cot 28^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}+\sqrt{3}-1\right)\left(5+\sqrt{5}-\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 28^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}+1+\sqrt{5}-2\sqrt{3}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\csc 28^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}-1-\sqrt{5}+2\sqrt{3}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\sin 34^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\cos 34^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\tan 34^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}+5-\sqrt{5}-3\sqrt{2}+\sqrt{3}-\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 34^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}-5+\sqrt{5}-3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 34^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}-\sqrt{6}+\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}\right]$$

$$\csc 34^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}+\sqrt{6}-\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}\right]$$

$$\sin 43^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\cos 43^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\tan 43^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}+\sqrt{3}-1\right)\left(5+\sqrt{5}+\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}-\sqrt{15}-\sqrt{30}\right)$$

$$\cot 43^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}-\sqrt{3}+1\right)\left(5+\sqrt{5}-\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 43^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}+1+\sqrt{5}-2\sqrt{3}\right)\left[2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}\right]$$

$$\csc 43^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}-1-\sqrt{5}+2\sqrt{3}\right)\left[2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}\right]$$

$$\sin 46^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\cos 46^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\tan 46^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}-\sqrt{3}+1\right)\left(5+\sqrt{5}-\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 46^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}+\sqrt{3}-1\right)\left(5+\sqrt{5}+\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}-\sqrt{15}-\sqrt{30}\right)$$

$$\sec 46^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}-1-\sqrt{5}+2\sqrt{3}\right)\left[2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}\right]$$

$$\csc 46^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}+1+\sqrt{5}-2\sqrt{3}\right)\left[2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}\right]$$

$$\sin 55^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\cos 55^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\tan 55^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}-5+\sqrt{5}-3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 55^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}+5-\sqrt{5}-3\sqrt{2}+\sqrt{3}-\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 55^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}+\sqrt{6}-\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}\right]$$

$$\csc 55^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}-\sqrt{6}+\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}\right]$$

$$\sin 61^\circ 30' = \frac{2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\cos 61^\circ 30' = \frac{2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\tan 61^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}+\sqrt{3}-1\right)\left(5+\sqrt{5}-\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 61^\circ 30' = \frac{1}{4}\left(\sqrt{5+\sqrt{5}}-\sqrt{3}+1\right)\left(5+\sqrt{5}+\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}-\sqrt{15}-\sqrt{30}\right)$$

$$\sec 61^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}-1-\sqrt{5}+2\sqrt{3}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\csc 61^\circ 30' = \frac{1}{8}\left(\sqrt{10}-\sqrt{6}+1+\sqrt{5}-2\sqrt{3}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\sin 64^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\cos 64^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\tan 64^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}-\sqrt{3}+1\right)\left(5-\sqrt{5}-\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 64^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}+\sqrt{3}-1\right)\left(5-\sqrt{5}+\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}+\sqrt{15}-\sqrt{30}\right)$$

$$\sec 64^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}-1+\sqrt{5}+2\sqrt{3}\right)\left[\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\csc 64^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}+1-\sqrt{5}-2\sqrt{3}\right)\left[\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\sin 70^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}+\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}}{16}$$

$$\cos 70^\circ 30' = \frac{2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}-\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}}{16}$$

$$\tan 70^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}-\sqrt{5}+5-3\sqrt{2}+\sqrt{3}-\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 70^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5-\sqrt{5}}\right)\left(\sqrt{10}+\sqrt{5}-5-3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 70^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}-\sqrt{6}+\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}\right]$$

$$\csc 70^\circ 30' = \frac{1}{8}\left(2\sqrt{3}+1-\sqrt{5}+\sqrt{6}-\sqrt{10}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}\right]$$

$$\sin 73^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\cos 73^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\tan 73^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}-5-\sqrt{5}+3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\cot 73^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}+5+\sqrt{5}+3\sqrt{2}+\sqrt{3}+\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\sec 73^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1-\sqrt{6}-\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\csc 73^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1+\sqrt{6}+\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\sin 79^\circ 30' = \frac{\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\cos 79^\circ 30' = \frac{\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\tan 79^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}+\sqrt{3}-1\right)\left(5-\sqrt{5}-\sqrt{10}+3\sqrt{2}-\sqrt{3}-\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 79^\circ 30' = \frac{1}{4}\left(\sqrt{5-\sqrt{5}}-\sqrt{3}+1\right)\left(5-\sqrt{5}+\sqrt{10}-3\sqrt{2}-\sqrt{3}+\sqrt{6}+\sqrt{15}-\sqrt{30}\right)$$

$$\sec 79^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}-1+\sqrt{5}+2\sqrt{3}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}-\sqrt{6}\right)}+\left(3-\sqrt{5}\right)\sqrt{8+2\sqrt{2}+2\sqrt{6}}\right]$$

$$\csc 79^\circ 30' = \frac{1}{8}\left(\sqrt{6}+\sqrt{10}+1-\sqrt{5}-2\sqrt{3}\right)\left[2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}+\sqrt{6}\right)}-\left(3-\sqrt{5}\right)\sqrt{8-2\sqrt{2}-2\sqrt{6}}\right]$$

$$\sin 88^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}+2\sqrt{\left(5-\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}}{16}$$

$$\cos 88^\circ 30' = \frac{\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}-2\sqrt{\left(5-\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}}{16}$$

$$\tan 88^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1+\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}+\sqrt{5}+5+3\sqrt{2}+\sqrt{3}+\sqrt{6}+\sqrt{15}+\sqrt{30}\right)$$

$$\cot 88^\circ 30' = \frac{1}{4}\left(\sqrt{3}+1-\sqrt{5+\sqrt{5}}\right)\left(\sqrt{10}-\sqrt{5}-5+3\sqrt{2}-\sqrt{3}+\sqrt{6}-\sqrt{15}+\sqrt{30}\right)$$

$$\sec 88^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1+\sqrt{6}+\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8+2\sqrt{2}-2\sqrt{6}}+2\sqrt{\left(5+\sqrt{5}\right)\left(4-\sqrt{2}+\sqrt{6}\right)}\right]$$

$$\csc 88^\circ 30' = \frac{1}{8}\left(\sqrt{5}+2\sqrt{3}+1-\sqrt{6}-\sqrt{10}\right)\left[\left(3+\sqrt{5}\right)\sqrt{8-2\sqrt{2}+2\sqrt{6}}-2\sqrt{\left(5+\sqrt{5}\right)\left(4+\sqrt{2}-\sqrt{6}\right)}\right]$$

$$\sin\frac{90^\circ}{17} = -\frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34-2\sqrt{17}}}{16}-\frac{\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cos\frac{90^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}+2\sqrt{34-2\sqrt{17}}+4\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\tan\frac{90^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{90^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\csc\frac{90^\circ}{17} = \frac{1}{2}\left(2+\sqrt{17}+\sqrt{17+4\sqrt{17}}+\sqrt{34+4\sqrt{17}+2\sqrt{289+52\sqrt{17}}}\right)$$

$$\sin\frac{180^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}-2\sqrt{34-2\sqrt{17}}-4\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\cos\frac{180^\circ}{17} = \frac{1}{16}-\frac{\sqrt{17}}{16}+\frac{\sqrt{34-2\sqrt{17}}}{16}+\frac{\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cot\frac{180^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{180^\circ}{17} = \frac{1}{2}\left(\sqrt{34+4\sqrt{17}-2\sqrt{289+52\sqrt{17}}}-2-\sqrt{17}+\sqrt{17+4\sqrt{17}}\right)$$

$$\csc\frac{180^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sin\frac{270^\circ}{17} = \frac{1}{16} + \frac{\sqrt{17}}{16} - \frac{\sqrt{34+2\sqrt{17}}}{16} + \frac{\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cos\frac{270^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}+2\sqrt{34+2\sqrt{17}}+4\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\tan\frac{270^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{270^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\csc\frac{270^\circ}{17} = \frac{1}{2}\left(\sqrt{34-4\sqrt{17}+2\sqrt{289-52\sqrt{17}}}-2+\sqrt{17}-\sqrt{17-4\sqrt{17}}\right)$$

$$\sin\frac{360^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}+2\sqrt{34-2\sqrt{17}}-4\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\cos\frac{360^\circ}{17} = -\frac{1}{16} + \frac{\sqrt{17}}{16} + \frac{\sqrt{34-2\sqrt{17}}}{16} + \frac{\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cot\frac{360^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{360^\circ}{17} = \frac{1}{2}\left(2+\sqrt{17}+\sqrt{17+4\sqrt{17}}-\sqrt{34+4\sqrt{17}+2\sqrt{289+52\sqrt{17}}}\right)$$

$$\csc\frac{360^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sin\frac{450^\circ}{17} = -\frac{1}{16} - \frac{\sqrt{17}}{16} + \frac{\sqrt{34+2\sqrt{17}}}{16} + \frac{\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cos\frac{450^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}+2\sqrt{34+2\sqrt{17}}-4\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\tan\frac{450^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{450^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\csc\frac{450^\circ}{17} = \frac{1}{2}\left(2-\sqrt{17}+\sqrt{17-4\sqrt{17}}+\sqrt{34-4\sqrt{17}+2\sqrt{289-52\sqrt{17}}}\right)$$

$$\sin\frac{540^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}-2\sqrt{34+2\sqrt{17}}-4\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\cos\frac{540^\circ}{17} = \frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34+2\sqrt{17}}}{16}+\frac{\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cot\frac{540^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{540^\circ}{17} = \frac{1}{2}\left(\sqrt{17}+\sqrt{17-4\sqrt{17}}-2-\sqrt{34-4\sqrt{17}-2\sqrt{289-52\sqrt{17}}}\right)$$

$$\csc\frac{540^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sin\frac{630^\circ}{17} = \frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34+2\sqrt{17}}}{16}-\frac{\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cos\frac{630^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}-2\sqrt{34+2\sqrt{17}}+4\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\tan\frac{630^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{630^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\csc\frac{630^\circ}{17} = \frac{1}{2}\left(\sqrt{34-4\sqrt{17}-2\sqrt{289-52\sqrt{17}}}-2+\sqrt{17}+\sqrt{17-4\sqrt{17}}\right)$$

$$\sin\frac{720^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}-2\sqrt{34-2\sqrt{17}}+4\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\cos\frac{720^\circ}{17} = -\frac{1}{16}+\frac{\sqrt{17}}{16}-\frac{\sqrt{34-2\sqrt{17}}}{16}+\frac{\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cot\frac{720^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{720^\circ}{17} = \frac{1}{2}\left(2+\sqrt{17}-\sqrt{17+4\sqrt{17}}+\sqrt{34+4\sqrt{17}-2\sqrt{289+52\sqrt{17}}}\right)$$

$$\csc\frac{720^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sin\frac{810^\circ}{17} = -\frac{1}{16}+\frac{\sqrt{17}}{16}-\frac{\sqrt{34-2\sqrt{17}}}{16}+\frac{\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cos\frac{810^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}-2\sqrt{34-2\sqrt{17}}+4\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\tan\frac{810^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{810^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\csc\frac{810^\circ}{17} = \frac{1}{2}\left(2+\sqrt{17}-\sqrt{17+4\sqrt{17}}+\sqrt{34+4\sqrt{17}-2\sqrt{289+52\sqrt{17}}}\right)$$

$$\sin\frac{900^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}-2\sqrt{34+2\sqrt{17}}+4\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\cos\frac{900^\circ}{17} = \frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34+2\sqrt{17}}}{16}-\frac{\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cot\frac{900^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{900^\circ}{17} = \frac{1}{2}\left(\sqrt{34-4\sqrt{17}-2\sqrt{289-52\sqrt{17}}}-2+\sqrt{17}+\sqrt{17-4\sqrt{17}}\right)$$

$$\csc\frac{900^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sin\frac{990^\circ}{17} = \frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34+2\sqrt{17}}}{16}+\frac{\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cos\frac{990^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}-2\sqrt{34+2\sqrt{17}}-4\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\tan\frac{990^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{990^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}+289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}+34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\csc\frac{990^\circ}{17} = \frac{1}{2}\left(\sqrt{17}+\sqrt{17-4\sqrt{17}}-2-\sqrt{34-4\sqrt{17}-2\sqrt{289-52\sqrt{17}}}\right)$$

$$\sin\frac{1080^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}+2\sqrt{34+2\sqrt{17}}-4\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\cos\frac{1080^\circ}{17} = -\frac{1}{16}-\frac{\sqrt{17}}{16}+\frac{\sqrt{34+2\sqrt{17}}}{16}+\frac{\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cot\frac{1080^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{1080^\circ}{17} = \frac{1}{2}\left(2-\sqrt{17}+\sqrt{17-4\sqrt{17}}+\sqrt{34-4\sqrt{17}+2\sqrt{289-52\sqrt{17}}}\right)$$

$$\csc\frac{1080^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}+17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sin\frac{1170^\circ}{17} = -\frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34-2\sqrt{17}}}{16}+\frac{\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cos\frac{1170^\circ}{17} = \frac{\sqrt{34-2\sqrt{17}+2\sqrt{34-2\sqrt{17}}-4\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\tan\frac{1170^\circ}{17} = \frac{\sqrt{1445+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{1170^\circ}{17} = \frac{\sqrt{1734+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\csc\frac{1170^\circ}{17} = \frac{1}{2}\left(2+\sqrt{17}+\sqrt{17+4\sqrt{17}}-\sqrt{34+4\sqrt{17}+2\sqrt{289+52\sqrt{17}}}\right)$$

$$\sin\frac{1260^\circ}{17} = \frac{\sqrt{34+2\sqrt{17}+2\sqrt{34+2\sqrt{17}}+4\sqrt{17-3\sqrt{17}-\sqrt{170-38\sqrt{17}}}}}{8}$$

$$\cos\frac{1260^\circ}{17} = \frac{1}{16}+\frac{\sqrt{17}}{16}-\frac{\sqrt{34+2\sqrt{17}}}{16}+\frac{\sqrt{17-3\sqrt{17}+\sqrt{170-38\sqrt{17}}}}{8}$$

$$\cot\frac{1260^\circ}{17} = \frac{\sqrt{1445-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sec\frac{1260^\circ}{17} = \frac{1}{2}\left(\sqrt{34-4\sqrt{17}+2\sqrt{289-52\sqrt{17}}}-2+\sqrt{17}-\sqrt{17-4\sqrt{17}}\right)$$

$$\csc\frac{1260^\circ}{17} = \frac{\sqrt{1734-289\sqrt{17}-289\sqrt{17-4\sqrt{17}}-17\sqrt{14450-3468\sqrt{17}-34\sqrt{282353-68476\sqrt{17}}}}}{17}$$

$$\sin\frac{1350^\circ}{17}=\frac{1}{16}-\frac{\sqrt{17}}{16}+\frac{\sqrt{34-2\sqrt{17}}}{16}+\frac{\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cos\frac{1350^\circ}{17}=\frac{\sqrt{34-2\sqrt{17}-2\sqrt{34-2\sqrt{17}}-4\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\tan\frac{1350^\circ}{17}=\frac{\sqrt{1445+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{1350^\circ}{17}=\frac{\sqrt{1734+289\sqrt{17}+289\sqrt{17+4\sqrt{17}}+17\sqrt{14450+3468\sqrt{17}+34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\csc\frac{1350^\circ}{17}=\frac{1}{2}\left(\sqrt{34+4\sqrt{17}-2\sqrt{289+52\sqrt{17}}}-2-\sqrt{17}+\sqrt{17+4\sqrt{17}}\right)$$

$$\sin\frac{1440^\circ}{17}=\frac{\sqrt{34-2\sqrt{17}+2\sqrt{34-2\sqrt{17}}+4\sqrt{17+3\sqrt{17}+\sqrt{170+38\sqrt{17}}}}}{8}$$

$$\cos\frac{1440^\circ}{17}=-\frac{1}{16}+\frac{\sqrt{17}}{16}+\frac{\sqrt{34-2\sqrt{17}}}{16}-\frac{\sqrt{17+3\sqrt{17}-\sqrt{170+38\sqrt{17}}}}{8}$$

$$\cot\frac{1440^\circ}{17}=\frac{\sqrt{1445+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sec\frac{1440^\circ}{17}=\frac{1}{2}\left(2+\sqrt{17}+\sqrt{17+4\sqrt{17}}+\sqrt{34+4\sqrt{17}+2\sqrt{289+52\sqrt{17}}}\right)$$

$$\csc\frac{1440^\circ}{17}=\frac{\sqrt{1734+289\sqrt{17}-289\sqrt{17+4\sqrt{17}}-17\sqrt{14450+3468\sqrt{17}-34\sqrt{282353+68476\sqrt{17}}}}}{17}$$

$$\sin 3^\circ 45'=\frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}$$

$$\cos 3^\circ 45'=\frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}$$

$$\tan 3^\circ 45'=\sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}}-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 3^\circ 45'=\sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}}+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sec 3^\circ 45'=\sqrt{\left(4\sqrt{3}+8+3\sqrt{6}+5\sqrt{2}\right)\left(4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\csc 3^\circ 45'=\sqrt{\left(4\sqrt{3}+8+3\sqrt{6}+5\sqrt{2}\right)\left(4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\sin 4^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}-\sqrt{10}-2\sqrt{5-\sqrt{5}}}$$

$$\cos 4^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}+\sqrt{10}+2\sqrt{5-\sqrt{5}}}$$

$$\tan 4^\circ 30' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left(\sqrt{5}+1-\sqrt{5+\sqrt{5}}\right)$$

$$\cot 4^\circ 30' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left(\sqrt{5}+1+\sqrt{5+\sqrt{5}}\right)$$

$$\sec 4^\circ 30' = \frac{1}{2}\left(\sqrt{5}-2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2+\sqrt{2}\right)}-\sqrt{2-\sqrt{2}}\right]$$

$$\csc 4^\circ 30' = \frac{1}{2}\left(\sqrt{5}+2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2-\sqrt{2}\right)}+\sqrt{2+\sqrt{2}}\right]$$

$$\sin 13^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}-\sqrt{10}-2\sqrt{5+\sqrt{5}}}$$

$$\cos 13^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}+\sqrt{10}+2\sqrt{5+\sqrt{5}}}$$

$$\tan 13^\circ 30' = \frac{1}{4}\left(4+\sqrt{2}-\sqrt{10}\right)\left(\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right)$$

$$\cot 13^\circ 30' = \frac{1}{4}\left(4-\sqrt{2}+\sqrt{10}\right)\left(\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right)$$

$$\sec 13^\circ 30' = \frac{1}{2}\left(2\sqrt{2}-\sqrt{5}+1\right)\left[\sqrt{2+\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(2-\sqrt{2}\right)}\right]$$

$$\csc 13^\circ 30' = \frac{1}{2}\left(2\sqrt{2}+\sqrt{5}-1\right)\left[\sqrt{2-\sqrt{2}}+\sqrt{\left(5-2\sqrt{5}\right)\left(2+\sqrt{2}\right)}\right]$$

$$\sin 18^\circ 45' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}$$

$$\cos 18^\circ 45' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}$$

$$\tan 18^\circ 45' = \sqrt{16+6\sqrt{6}-8\sqrt{3}-10\sqrt{2}}-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 18^\circ 45' = \sqrt{16+6\sqrt{6}-8\sqrt{3}-10\sqrt{2}}+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sec 18^\circ 45' = \sqrt{\left(8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}\right)\left(4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\csc 18^\circ 45' = \sqrt{\left(8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}\right)\left(4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\sin 26^\circ 15' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}$$

$$\cos 26^\circ 15' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}$$

$$\tan 26^\circ 15' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}}-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 26^\circ 15' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}}+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 26^\circ 15' = \sqrt{\left(8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}\right)\left(4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\csc 26^\circ 15' = \sqrt{\left(8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}\right)\left(4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\sin 31^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}+\sqrt{10}-2\sqrt{5+\sqrt{5}}}$$

$$\cos 31^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}-\sqrt{10}+2\sqrt{5+\sqrt{5}}}$$

$$\tan 31^\circ 30' = \frac{1}{4}\left(4+\sqrt{10}-\sqrt{2}\right)\left(\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right)$$

$$\cot 31^\circ 30' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left(\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right)$$

$$\sec 31^\circ 30' = \frac{1}{2}\left(2\sqrt{2}+\sqrt{5}-1\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(2+\sqrt{2}\right)}-\sqrt{2-\sqrt{2}}\right]$$

$$\csc 31^\circ 30' = \frac{1}{2}\left(2\sqrt{2}-\sqrt{5}+1\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(2-\sqrt{2}\right)}+\sqrt{2+\sqrt{2}}\right]$$

$$\sin 40^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}-\sqrt{10}+2\sqrt{5-\sqrt{5}}}$$

$$\cos 40^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}+\sqrt{10}-2\sqrt{5-\sqrt{5}}}$$

$$\tan 40^\circ 30' = \frac{1}{4}\left(\sqrt{2}+\sqrt{10}-4\right)\left(\sqrt{5}+1+\sqrt{5+\sqrt{5}}\right)$$

$$\cot 40^\circ 30' = \frac{1}{4}\left(\sqrt{2}+\sqrt{10}+4\right)\left(\sqrt{5}+1-\sqrt{5+\sqrt{5}}\right)$$

$$\sec 40^\circ 30' = \frac{1}{2}\left(\sqrt{5}-2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2+\sqrt{2}\right)}+\sqrt{2-\sqrt{2}}\right]$$

$$\csc 40^\circ 30' = \frac{1}{2}\left(\sqrt{5}+2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2-\sqrt{2}\right)}-\sqrt{2+\sqrt{2}}\right]$$

$$\sin 41^\circ 15' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}$$

$$\cos 41^\circ 15' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}$$

$$\tan 41^\circ 15' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}}-\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 41^\circ 15' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}}+\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 41^\circ 15' = \sqrt{\left(4\sqrt{3}+8-3\sqrt{6}-5\sqrt{2}\right)\left(4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\csc 41^\circ 15' = \sqrt{\left(4\sqrt{3}+8-3\sqrt{6}-5\sqrt{2}\right)\left(4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\sin 48^\circ 45' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}$$

$$\cos 48^\circ 45' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{6}-2\sqrt{2}}}$$

$$\tan 48^\circ 45' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}}+\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 48^\circ 45' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}}-\left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 48^\circ 45' = \sqrt{\left(4\sqrt{3}+8-3\sqrt{6}-5\sqrt{2}\right)\left(4+\sqrt{8-2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\csc 48^\circ 45' = \sqrt{\left(4\sqrt{3}+8-3\sqrt{6}-5\sqrt{2}\right)\left(4-\sqrt{8-2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\sin 49^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}+\sqrt{10}-2\sqrt{5-\sqrt{5}}}$$

$$\cos 49^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}-\sqrt{10}+2\sqrt{5-\sqrt{5}}}$$

$$\tan 49^\circ 30' = \frac{1}{4}\left(\sqrt{2}+\sqrt{10}+4\right)\left(\sqrt{5}+1-\sqrt{5+\sqrt{5}}\right)$$

$$\cot 49^\circ 30' = \frac{1}{4}\left(\sqrt{2}+\sqrt{10}-4\right)\left(\sqrt{5}+1+\sqrt{5+\sqrt{5}}\right)$$

$$\sec 49^\circ 30' = \frac{1}{2}\left(\sqrt{5}+2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2-\sqrt{2}\right)}-\sqrt{2+\sqrt{2}}\right]$$

$$\csc 49^\circ 30' = \frac{1}{2}\left(\sqrt{5}-2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2+\sqrt{2}\right)}+\sqrt{2-\sqrt{2}}\right]$$

$$\sin 58^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}-\sqrt{10}+2\sqrt{5+\sqrt{5}}}$$

$$\cos 58^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}+\sqrt{10}-2\sqrt{5+\sqrt{5}}}$$

$$\tan 58^\circ 30' = \frac{1}{4}\left(4-\sqrt{10}+\sqrt{2}\right)\left(\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right)$$

$$\cot 58^\circ 30' = \frac{1}{4}\left(4+\sqrt{10}-\sqrt{2}\right)\left(\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right)$$

$$\sec 58^\circ 30' = \frac{1}{2}\left(2\sqrt{2}-\sqrt{5}+1\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(2-\sqrt{2}\right)}+\sqrt{2+\sqrt{2}}\right]$$

$$\csc 58^\circ 30' = \frac{1}{2}\left(2\sqrt{2}+\sqrt{5}-1\right)\left[\sqrt{\left(5-2\sqrt{5}\right)\left(2+\sqrt{2}\right)}-\sqrt{2-\sqrt{2}}\right]$$

$$\sin 63^\circ 45' = \frac{1}{4}\sqrt{8+2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}$$

$$\cos 63^\circ 45' = \frac{1}{4}\sqrt{8-2\sqrt{8-2\sqrt{6}+2\sqrt{2}}}$$

$$\tan 63^\circ 45' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}}+\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\cot 63^\circ 45' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}}-\left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 63^\circ 45' = \sqrt{\left(8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}\right)\left(4+\sqrt{8-2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\csc 63^\circ 45' = \sqrt{\left(8-4\sqrt{3}-3\sqrt{6}+5\sqrt{2}\right)\left(4-\sqrt{8-2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\sin 71^\circ 15' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}$$

$$\cos 71^\circ 15' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{6}-2\sqrt{2}}}$$

$$\tan 71^\circ 15' = \sqrt{16+6\sqrt{6}-8\sqrt{3}-10\sqrt{2}}+\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 71^\circ 15' = \sqrt{16+6\sqrt{6}-8\sqrt{3}-10\sqrt{2}}-\left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sec 71^\circ 15' = \sqrt{\left(8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}\right)\left(4+\sqrt{8+2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\csc 71^\circ 15' = \sqrt{\left(8-4\sqrt{3}+3\sqrt{6}-5\sqrt{2}\right)\left(4-\sqrt{8+2\sqrt{6}-2\sqrt{2}}\right)}$$

$$\sin 76^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}+\sqrt{10}+2\sqrt{5+\sqrt{5}}}$$

$$\cos 76^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}-\sqrt{10}-2\sqrt{5+\sqrt{5}}}$$

$$\tan 76^\circ 30' = \frac{1}{4}\left(4-\sqrt{2}+\sqrt{10}\right)\left(\sqrt{5-\sqrt{5}}+\sqrt{5}-1\right)$$

$$\cot 76^\circ 30' = \frac{1}{4}\left(4+\sqrt{2}-\sqrt{10}\right)\left(\sqrt{5-\sqrt{5}}-\sqrt{5}+1\right)$$

$$\sec 76^\circ 30' = \frac{1}{2}\left(2\sqrt{2}+\sqrt{5}-1\right)\left[\sqrt{2-\sqrt{2}}+\sqrt{\left(5-2\sqrt{5}\right)\left(2+\sqrt{2}\right)}\right]$$

$$\csc 76^\circ 30' = \frac{1}{2}\left(2\sqrt{2}-\sqrt{5}+1\right)\left[\sqrt{2+\sqrt{2}}-\sqrt{\left(5-2\sqrt{5}\right)\left(2-\sqrt{2}\right)}\right]$$

$$\sin 85^\circ 30' = \frac{1}{4}\sqrt{8+\sqrt{2}+\sqrt{10}+2\sqrt{5-\sqrt{5}}}$$

$$\cos 85^\circ 30' = \frac{1}{4}\sqrt{8-\sqrt{2}-\sqrt{10}-2\sqrt{5-\sqrt{5}}}$$

$$\tan 85^\circ 30' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}+4\right)\left(\sqrt{5}+1+\sqrt{5+\sqrt{5}}\right)$$

$$\cot 85^\circ 30' = \frac{1}{4}\left(\sqrt{10}+\sqrt{2}-4\right)\left(\sqrt{5}+1-\sqrt{5+\sqrt{5}}\right)$$

$$\sec 85^\circ 30' = \frac{1}{2}\left(\sqrt{5}+2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2-\sqrt{2}\right)}+\sqrt{2+\sqrt{2}}\right]$$

$$\csc 85^\circ 30' = \frac{1}{2}\left(\sqrt{5}-2\sqrt{2}+1\right)\left[\sqrt{\left(5+2\sqrt{5}\right)\left(2+\sqrt{2}\right)}-\sqrt{2-\sqrt{2}}\right]$$

$$\sin 86^\circ 15' = \frac{1}{4}\sqrt{8+2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}$$

$$\cos 86^\circ 15' = \frac{1}{4}\sqrt{8-2\sqrt{8+2\sqrt{6}+2\sqrt{2}}}$$

$$\tan 86^\circ 15' = \sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}}+\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 86^\circ 15' = \sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}}-\left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\sec 86^\circ 15' = \sqrt{\left(4\sqrt{3}+8+3\sqrt{6}+5\sqrt{2}\right)\left(4+\sqrt{8+2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\csc 86^\circ 15' = \sqrt{\left(4\sqrt{3}+8+3\sqrt{6}+5\sqrt{2}\right)\left(4-\sqrt{8+2\sqrt{6}+2\sqrt{2}}\right)}$$

$$\sin 33^\circ 45' = \frac{\sqrt{2-\sqrt{2-\sqrt{2}}}}{2} \qquad \sin 56^\circ 15' = \frac{\sqrt{2+\sqrt{2-\sqrt{2}}}}{2}$$

$$\cos 33^\circ 45' = \frac{\sqrt{2+\sqrt{2-\sqrt{2}}}}{2} \qquad \cos 56^\circ 15' = \frac{\sqrt{2-\sqrt{2-\sqrt{2}}}}{2}$$

$$\tan 33^\circ 45' = \sqrt{4-2\sqrt{2}}-\sqrt{2}+1 \qquad \tan 56^\circ 15' = \sqrt{4-2\sqrt{2}}+\sqrt{2}-1$$

$$\cot 33^\circ 45' = \sqrt{4-2\sqrt{2}}+\sqrt{2}-1 \qquad \cot 56^\circ 15' = \sqrt{4-2\sqrt{2}}-\sqrt{2}+1$$

$$\sec 33^\circ 45' = \sqrt{\left(4-2\sqrt{2}\right)\left(2-\sqrt{2-\sqrt{2}}\right)} \qquad \sec 56^\circ 15' = \sqrt{\left(4-2\sqrt{2}\right)\left(2+\sqrt{2-\sqrt{2}}\right)}$$

$$\csc 33^\circ 45' = \sqrt{\left(4-2\sqrt{2}\right)\left(2+\sqrt{2-\sqrt{2}}\right)} \qquad \csc 56^\circ 15' = \sqrt{\left(4-2\sqrt{2}\right)\left(2-\sqrt{2-\sqrt{2}}\right)}$$

$$\sin 11^\circ 15' = \frac{\sqrt{2-\sqrt{2+\sqrt{2}}}}{2} \qquad \sin 78^\circ 45' = \frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2}$$

$$\cos 11^\circ 15' = \frac{\sqrt{2+\sqrt{2+\sqrt{2}}}}{2} \qquad \cos 78^\circ 45' = \frac{\sqrt{2-\sqrt{2+\sqrt{2}}}}{2}$$

$$\tan 11^\circ 15' = \sqrt{4+2\sqrt{2}}-\sqrt{2}-1 \qquad \tan 78^\circ 45' = \sqrt{4+2\sqrt{2}}+\sqrt{2}+1$$

$$\cot 11^\circ 15' = \sqrt{4+2\sqrt{2}}+\sqrt{2}+1 \qquad \cot 78^\circ 45' = \sqrt{4+2\sqrt{2}}-\sqrt{2}-1$$

$$\sec 11^\circ 15' = \sqrt{\left(4+2\sqrt{2}\right)\left(2-\sqrt{2+\sqrt{2}}\right)} \qquad \sec 78^\circ 45' = \sqrt{\left(4+2\sqrt{2}\right)\left(2+\sqrt{2+\sqrt{2}}\right)}$$

$$\csc 11^\circ 15' = \sqrt{\left(4+2\sqrt{2}\right)\left(2+\sqrt{2+\sqrt{2}}\right)} \qquad \csc 78^\circ 45' = \sqrt{\left(4+2\sqrt{2}\right)\left(2-\sqrt{2+\sqrt{2}}\right)}$$

$$\sin 36^\circ = \frac{\sqrt{10-2\sqrt{5}}}{4} \qquad \sin 54^\circ = \frac{\sqrt{5}+1}{4} \qquad \sin 18^\circ = \frac{\sqrt{5}-1}{4} \qquad \sin 72^\circ = \frac{\sqrt{10+2\sqrt{5}}}{4}$$

$$\cos 36^\circ = \frac{\sqrt{5}+1}{4} \qquad \cos 54^\circ = \frac{\sqrt{10-2\sqrt{5}}}{4} \qquad \cos 18^\circ = \frac{\sqrt{10+2\sqrt{5}}}{4} \qquad \cos 72^\circ = \frac{\sqrt{5}-1}{4}$$

$$\tan 36^\circ = \sqrt{5-2\sqrt{5}} \qquad \tan 54^\circ = \frac{\sqrt{25+10\sqrt{5}}}{5} \qquad \tan 18^\circ = \frac{\sqrt{25-10\sqrt{5}}}{5} \qquad \tan 72^\circ = \sqrt{5+2\sqrt{5}}$$

$$\cot 36^\circ = \frac{\sqrt{25+10\sqrt{5}}}{5} \qquad \cot 54^\circ = \sqrt{5-2\sqrt{5}} \qquad \cot 18^\circ = \sqrt{5+2\sqrt{5}} \qquad \cot 72^\circ = \frac{\sqrt{25-10\sqrt{5}}}{5}$$

$$\sec 36^\circ = \sqrt{5}-1 \qquad \sec 54^\circ = \frac{\sqrt{50+10\sqrt{5}}}{5} \qquad \sec 18^\circ = \frac{\sqrt{50-10\sqrt{5}}}{5} \qquad \sec 72^\circ = \sqrt{5}+1$$

$$\csc 36^\circ = \frac{\sqrt{50+10\sqrt{5}}}{5} \qquad \csc 54^\circ = \sqrt{5}-1 \qquad \csc 18^\circ = \sqrt{5}+1 \qquad \csc 72^\circ = \frac{\sqrt{50-10\sqrt{5}}}{5}$$

$$\sin 9^\circ = \frac{1}{4}\sqrt{8-2\sqrt{10+2\sqrt{5}}} \qquad \sin 81^\circ = \frac{1}{4}\sqrt{8+2\sqrt{10+2\sqrt{5}}}$$

$$\cos 9^\circ = \frac{1}{4}\sqrt{8+2\sqrt{10+2\sqrt{5}}} \qquad \cos 81^\circ = \frac{1}{4}\sqrt{8-2\sqrt{10+2\sqrt{5}}}$$

$$\tan 9^\circ = \sqrt{5}+1-\sqrt{5+2\sqrt{5}} \qquad \tan 81^\circ = \sqrt{5}+1+\sqrt{5+2\sqrt{5}}$$

$$\cot 9^\circ = \sqrt{5}+1+\sqrt{5+2\sqrt{5}} \qquad \cot 81^\circ = \sqrt{5}+1-\sqrt{5+2\sqrt{5}}$$

$$\sec 9^\circ = \frac{1}{2}\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{10+2\sqrt{5}}} \qquad \sec 81^\circ = \frac{1}{2}\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{10+2\sqrt{5}}}$$

$$\csc 9^\circ = \frac{1}{2}\left(\sqrt{5}+1\right)\sqrt{8+2\sqrt{10+2\sqrt{5}}} \qquad \csc 81^\circ = \frac{1}{2}\left(\sqrt{5}+1\right)\sqrt{8-2\sqrt{10+2\sqrt{5}}}$$

$$\sin 15^\circ = \frac{\sqrt{6}-\sqrt{2}}{4} \qquad \sin 75^\circ = \frac{\sqrt{6}+\sqrt{2}}{4} \qquad \sin 22^\circ 30' = \frac{\sqrt{2-\sqrt{2}}}{2} \qquad \sin 67^\circ 30' = \frac{\sqrt{2+\sqrt{2}}}{2}$$

$$\cos 15^\circ = \frac{\sqrt{6}+\sqrt{2}}{4} \qquad \cos 75^\circ = \frac{\sqrt{6}-\sqrt{2}}{4} \qquad \cos 22^\circ 30' = \frac{\sqrt{2+\sqrt{2}}}{2} \qquad \cos 67^\circ 30' = \frac{\sqrt{2-\sqrt{2}}}{2}$$

$$\tan 15^\circ = 2-\sqrt{3} \qquad \tan 75^\circ = 2+\sqrt{3} \qquad \tan 22^\circ 30' = \sqrt{2}-1 \qquad \tan 67^\circ 30' = \sqrt{2}+1$$

$$\cot 15^\circ = 2+\sqrt{3} \qquad \cot 75^\circ = 2-\sqrt{3} \qquad \cot 22^\circ 30' = \sqrt{2}+1 \qquad \cot 67^\circ 30' = \sqrt{2}-1$$

$$\sec 15^\circ = \sqrt{6}-\sqrt{2} \qquad \sec 75^\circ = \sqrt{6}+\sqrt{2} \qquad \sec 22^\circ 30' = \sqrt{4-2\sqrt{2}} \qquad \sec 67^\circ 30' = \sqrt{4+2\sqrt{2}}$$

$$\csc 15^\circ = \sqrt{6}+\sqrt{2} \qquad \csc 75^\circ = \sqrt{6}-\sqrt{2} \qquad \csc 22^\circ 30' = \sqrt{4+2\sqrt{2}} \qquad \csc 67^\circ 30' = \sqrt{4-2\sqrt{2}}$$

$$\sin 7^\circ 30' = \frac{1}{4}\sqrt{8-2\sqrt{6}-2\sqrt{2}} \qquad \sin 82^\circ 30' = \frac{1}{4}\sqrt{8+2\sqrt{6}+2\sqrt{2}}$$

$$\cos 7^\circ 30' = \frac{1}{4}\sqrt{8+2\sqrt{6}+2\sqrt{2}} \qquad \cos 82^\circ 30' = \frac{1}{4}\sqrt{8-2\sqrt{6}-2\sqrt{2}}$$

$$\tan 7^\circ 30' = \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right) \qquad \tan 82^\circ 30' = \left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 7^\circ 30' = \left(\sqrt{2}+1\right)\left(\sqrt{3}+\sqrt{2}\right) \qquad \cot 82^\circ 30' = \left(\sqrt{2}-1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 7^\circ 30' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}} \qquad \sec 82^\circ 30' = \sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}}$$

$$\csc 7^\circ 30' = \sqrt{16+6\sqrt{6}+10\sqrt{2}+8\sqrt{3}} \qquad \csc 82^\circ 30' = \sqrt{16-6\sqrt{6}-10\sqrt{2}+8\sqrt{3}}$$

$$\sin 33^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}-\sqrt{15}+\sqrt{10-2\sqrt{5}}} \qquad \sin 57^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}+\sqrt{15}-\sqrt{10-2\sqrt{5}}}$$

$$\cos 33^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}+\sqrt{15}-\sqrt{10-2\sqrt{5}}} \qquad \cos 57^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}-\sqrt{15}+\sqrt{10-2\sqrt{5}}}$$

$$\tan 33^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}-1\right)\left(2\sqrt{5+2\sqrt{5}}+3+\sqrt{5}\right) \qquad \tan 57^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}+1\right)\left(2\sqrt{5+2\sqrt{5}}-3-\sqrt{5}\right)$$

$$\cot 33^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}+1\right)\left(2\sqrt{5+2\sqrt{5}}-3-\sqrt{5}\right) \qquad \cot 57^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}-1\right)\left(2\sqrt{5+2\sqrt{5}}+3+\sqrt{5}\right)$$

$$\sec 33^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(2-\sqrt{3}+\sqrt{5+2\sqrt{5}}\right) \qquad \sec 57^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(2+\sqrt{3}-\sqrt{5+2\sqrt{5}}\right)$$

$$\csc 33^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(2+\sqrt{3}-\sqrt{5+2\sqrt{5}}\right) \qquad \csc 57^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(2-\sqrt{3}+\sqrt{5+2\sqrt{5}}\right)$$

$$\sin 27^\circ = \frac{1}{4}\sqrt{8-2\sqrt{10-2\sqrt{5}}} \qquad \sin 63^\circ = \frac{1}{4}\sqrt{8+2\sqrt{10-2\sqrt{5}}}$$

$$\cos 27^\circ = \frac{1}{4}\sqrt{8+2\sqrt{10-2\sqrt{5}}} \qquad \cos 63^\circ = \frac{1}{4}\sqrt{8-2\sqrt{10-2\sqrt{5}}}$$

$$\tan 27^\circ = \sqrt{5}-1-\sqrt{5-2\sqrt{5}} \qquad \tan 63^\circ = \sqrt{5}-1+\sqrt{5-2\sqrt{5}}$$

$$\cot 27^\circ = \sqrt{5}-1+\sqrt{5-2\sqrt{5}} \qquad \cot 63^\circ = \sqrt{5}-1-\sqrt{5-2\sqrt{5}}$$

$$\sec 27^\circ = \frac{1}{2}\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{10-2\sqrt{5}}} \qquad \sec 63^\circ = \frac{1}{2}\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{10-2\sqrt{5}}}$$

$$\csc 27^\circ = \frac{1}{2}\left(\sqrt{5}-1\right)\sqrt{8+2\sqrt{10-2\sqrt{5}}} \qquad \csc 63^\circ = \frac{1}{2}\left(\sqrt{5}-1\right)\sqrt{8-2\sqrt{10-2\sqrt{5}}}$$

$$\sin 37^\circ 30' = \frac{1}{4}\sqrt{8-2\sqrt{6}+2\sqrt{2}} \qquad \sin 52^\circ 30' = \frac{1}{4}\sqrt{8+2\sqrt{6}-2\sqrt{2}}$$

$$\cos 37^\circ 30' = \frac{1}{4}\sqrt{8+2\sqrt{6}-2\sqrt{2}} \qquad \cos 52^\circ 30' = \frac{1}{4}\sqrt{8-2\sqrt{6}+2\sqrt{2}}$$

$$\tan 37^\circ 30' = \left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right) \qquad \tan 52^\circ 30' = \left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right)$$

$$\cot 37^\circ 30' = \left(\sqrt{2}-1\right)\left(\sqrt{3}+\sqrt{2}\right) \qquad \cot 52^\circ 30' = \left(\sqrt{2}+1\right)\left(\sqrt{3}-\sqrt{2}\right)$$

$$\sec 37^\circ 30' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}} \qquad \sec 52^\circ 30' = \sqrt{16+6\sqrt{6}-10\sqrt{2}-8\sqrt{3}}$$

$$\csc 37^\circ 30' = \sqrt{16+6\sqrt{6}-10\sqrt{2}-8\sqrt{3}} \qquad \csc 52^\circ 30' = \sqrt{16-6\sqrt{6}+10\sqrt{2}-8\sqrt{3}}$$

$$\sin 12^\circ = \frac{1}{8}\left(\sqrt{10+2\sqrt{5}} - \sqrt{15} + \sqrt{3}\right) \qquad \sin 78^\circ = \frac{1}{8}\left(\sqrt{30+6\sqrt{5}} + \sqrt{5} - 1\right)$$

$$\cos 12^\circ = \frac{1}{8}\left(\sqrt{30+6\sqrt{5}} + \sqrt{5} - 1\right) \qquad \cos 78^\circ = \frac{1}{8}\left(\sqrt{10+2\sqrt{5}} - \sqrt{15} + \sqrt{3}\right)$$

$$\tan 12^\circ = \frac{1}{2}\left(3\sqrt{3} - \sqrt{15} - \sqrt{50-22\sqrt{5}}\right) \qquad \tan 78^\circ = \frac{1}{2}\left(\sqrt{3} + \sqrt{15} + \sqrt{10+2\sqrt{5}}\right)$$

$$\cot 12^\circ = \frac{1}{2}\left(\sqrt{3} + \sqrt{15} + \sqrt{10+2\sqrt{5}}\right) \qquad \cot 78^\circ = \frac{1}{2}\left(3\sqrt{3} - \sqrt{15} - \sqrt{50-22\sqrt{5}}\right)$$

$$\sec 12^\circ = \sqrt{15-6\sqrt{5}} - \sqrt{5} + 2 \qquad \sec 78^\circ = \sqrt{5+2\sqrt{5}} + \sqrt{3}$$

$$\csc 12^\circ = \sqrt{5+2\sqrt{5}} + \sqrt{3} \qquad \csc 78^\circ = \sqrt{15-6\sqrt{5}} - \sqrt{5} + 2$$

$$\sin 24^\circ = \frac{1}{8}\left(\sqrt{3} + \sqrt{15} - \sqrt{10-2\sqrt{5}}\right) \qquad \sin 66^\circ = \frac{1}{8}\left(1 + \sqrt{5} + \sqrt{30-6\sqrt{5}}\right)$$

$$\cos 24^\circ = \frac{1}{8}\left(1 + \sqrt{5} + \sqrt{30-6\sqrt{5}}\right) \qquad \cos 66^\circ = \frac{1}{8}\left(\sqrt{3} + \sqrt{15} - \sqrt{10-2\sqrt{5}}\right)$$

$$\tan 24^\circ = \frac{1}{2}\left(\sqrt{50+22\sqrt{5}} - 3\sqrt{3} - \sqrt{15}\right) \qquad \tan 66^\circ = \frac{1}{2}\left(\sqrt{10-2\sqrt{5}} - \sqrt{3} + \sqrt{15}\right)$$

$$\cot 24^\circ = \frac{1}{2}\left(\sqrt{10-2\sqrt{5}} - \sqrt{3} + \sqrt{15}\right) \qquad \cot 66^\circ = \frac{1}{2}\left(\sqrt{50+22\sqrt{5}} - 3\sqrt{3} - \sqrt{15}\right)$$

$$\sec 24^\circ = \sqrt{15+6\sqrt{5}} - 2 - \sqrt{5} \qquad \sec 66^\circ = \sqrt{5-2\sqrt{5}} + \sqrt{3}$$

$$\csc 24^\circ = \sqrt{5-2\sqrt{5}} + \sqrt{3} \qquad \csc 66^\circ = \sqrt{15+6\sqrt{5}} - 2 - \sqrt{5}$$

$$\sin 42^\circ = \frac{1}{8}\left(\sqrt{30+6\sqrt{5}} - \sqrt{5} + 1\right) \qquad \sin 48^\circ = \frac{1}{8}\left(\sqrt{10+2\sqrt{5}} + \sqrt{15} - \sqrt{3}\right)$$

$$\cos 42^\circ = \frac{1}{8}\left(\sqrt{10+2\sqrt{5}} + \sqrt{15} - \sqrt{3}\right) \qquad \cos 48^\circ = \frac{1}{8}\left(\sqrt{30+6\sqrt{5}} - \sqrt{5} + 1\right)$$

$$\tan 42^\circ = \frac{1}{2}\left(\sqrt{3} + \sqrt{15} - \sqrt{10+2\sqrt{5}}\right) \qquad \tan 48^\circ = \frac{1}{2}\left(3\sqrt{3} - \sqrt{15} + \sqrt{50-22\sqrt{5}}\right)$$

$$\cot 42^\circ = \frac{1}{2}\left(3\sqrt{3} - \sqrt{15} + \sqrt{50-22\sqrt{5}}\right) \qquad \cot 48^\circ = \frac{1}{2}\left(\sqrt{3} + \sqrt{15} - \sqrt{10+2\sqrt{5}}\right)$$

$$\sec 42^\circ = \sqrt{5+2\sqrt{5}} - \sqrt{3} \qquad \sec 48^\circ = \sqrt{15-6\sqrt{5}} + \sqrt{5} - 2$$

$$\csc 42^\circ = \sqrt{15-6\sqrt{5}} + \sqrt{5} - 2 \qquad \csc 48^\circ = \sqrt{5+2\sqrt{5}} - \sqrt{3}$$

$$\sin 69^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}+\sqrt{15}+\sqrt{10+2\sqrt{5}}} \qquad \sin 21^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}-\sqrt{15}-\sqrt{10+2\sqrt{5}}}$$

$$\cos 69^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}-\sqrt{15}-\sqrt{10+2\sqrt{5}}} \qquad \cos 21^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}+\sqrt{15}+\sqrt{10+2\sqrt{5}}}$$

$$\tan 69^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}-1\right)\left(2\sqrt{5-2\sqrt{5}}+3-\sqrt{5}\right) \qquad \tan 21^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}+1\right)\left(2\sqrt{5-2\sqrt{5}}-3+\sqrt{5}\right)$$

$$\cot 69^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}+1\right)\left(2\sqrt{5-2\sqrt{5}}-3+\sqrt{5}\right) \qquad \cot 21^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}-1\right)\left(2\sqrt{5-2\sqrt{5}}+3-\sqrt{5}\right)$$

$$\sec 69^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(2-\sqrt{3}+\sqrt{5-2\sqrt{5}}\right) \qquad \sec 21^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(2+\sqrt{3}-\sqrt{5-2\sqrt{5}}\right)$$

$$\csc 69^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(2+\sqrt{3}-\sqrt{5-2\sqrt{5}}\right) \qquad \csc 21^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(2-\sqrt{3}+\sqrt{5-2\sqrt{5}}\right)$$

$$\sin 3^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}-\sqrt{15}-\sqrt{10-2\sqrt{5}}} \qquad \sin 87^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}+\sqrt{15}+\sqrt{10-2\sqrt{5}}}$$

$$\cos 3^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}+\sqrt{15}+\sqrt{10-2\sqrt{5}}} \qquad \cos 87^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}-\sqrt{15}-\sqrt{10-2\sqrt{5}}}$$

$$\tan 3^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}-1\right)\left(2\sqrt{5+2\sqrt{5}}-3-\sqrt{5}\right) \qquad \tan 87^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}+1\right)\left(2\sqrt{5+2\sqrt{5}}+3+\sqrt{5}\right)$$

$$\cot 3^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}+1\right)\left(2\sqrt{5+2\sqrt{5}}+3+\sqrt{5}\right) \qquad \cot 87^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}-1\right)\left(2\sqrt{5+2\sqrt{5}}-3-\sqrt{5}\right)$$

$$\sec 3^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(\sqrt{5+2\sqrt{5}}-2+\sqrt{3}\right) \qquad \sec 87^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5+2\sqrt{5}}+2+\sqrt{3}\right)$$

$$\csc 3^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5+2\sqrt{5}}+2+\sqrt{3}\right) \qquad \csc 87^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(\sqrt{5+2\sqrt{5}}-2+\sqrt{3}\right)$$

$$\sin 6^\circ = \frac{1}{8}\left(\sqrt{30-6\sqrt{5}}-\sqrt{5}-1\right) \qquad \sin 84^\circ = \frac{1}{8}\left(\sqrt{10-2\sqrt{5}}+\sqrt{15}+\sqrt{3}\right)$$

$$\cos 6^\circ = \frac{1}{8}\left(\sqrt{10-2\sqrt{5}}+\sqrt{15}+\sqrt{3}\right) \qquad \cos 84^\circ = \frac{1}{8}\left(\sqrt{30-6\sqrt{5}}-\sqrt{5}-1\right)$$

$$\tan 6^\circ = \frac{1}{2}\left(\sqrt{10-2\sqrt{5}}+\sqrt{3}-\sqrt{15}\right) \qquad \tan 84^\circ = \frac{1}{2}\left(\sqrt{50+22\sqrt{5}}+3\sqrt{3}+\sqrt{15}\right)$$

$$\cot 6^\circ = \frac{1}{2}\left(\sqrt{50+22\sqrt{5}}+3\sqrt{3}+\sqrt{15}\right) \qquad \cot 84^\circ = \frac{1}{2}\left(\sqrt{10-2\sqrt{5}}+\sqrt{3}-\sqrt{15}\right)$$

$$\sec 6^\circ = \sqrt{3}-\sqrt{5-2\sqrt{5}} \qquad \sec 84^\circ = \sqrt{15+6\sqrt{5}}+\sqrt{5}+2$$

$$\csc 6^\circ = \sqrt{15+6\sqrt{5}}+\sqrt{5}+2 \qquad \csc 84^\circ = \sqrt{3}-\sqrt{5-2\sqrt{5}}$$

$$\sin 39^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}+\sqrt{15}-\sqrt{10+2\sqrt{5}}} \qquad \sin 51^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}-\sqrt{15}+\sqrt{10+2\sqrt{5}}}$$

$$\cos 39^\circ = \frac{1}{4}\sqrt{8+\sqrt{3}-\sqrt{15}+\sqrt{10+2\sqrt{5}}} \qquad \cos 51^\circ = \frac{1}{4}\sqrt{8-\sqrt{3}+\sqrt{15}-\sqrt{10+2\sqrt{5}}}$$

$$\tan 39^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}-1\right)\left(2\sqrt{5-2\sqrt{5}}-3+\sqrt{5}\right) \qquad \tan 51^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}+1\right)\left(2\sqrt{5-2\sqrt{5}}+3-\sqrt{5}\right)$$

$$\cot 39^\circ = \frac{1}{4}\left(2\sqrt{3}-\sqrt{5}+1\right)\left(2\sqrt{5-2\sqrt{5}}+3-\sqrt{5}\right) \qquad \cot 51^\circ = \frac{1}{4}\left(2\sqrt{3}+\sqrt{5}-1\right)\left(2\sqrt{5-2\sqrt{5}}-3+\sqrt{5}\right)$$

$$\sec 39^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5-2\sqrt{5}}-2+\sqrt{3}\right) \qquad \sec 51^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(\sqrt{5-2\sqrt{5}}+2+\sqrt{3}\right)$$

$$\csc 39^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}-\sqrt{3}\right)\left(\sqrt{5-2\sqrt{5}}+2+\sqrt{3}\right) \qquad \csc 51^\circ = \frac{\sqrt{2}}{2}\left(\sqrt{5}+\sqrt{3}\right)\left(\sqrt{5-2\sqrt{5}}-2+\sqrt{3}\right)$$